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DRESSINGS FOR PRUNING WOUNDS OF TREES

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The matter of dressings or protective coverings for wounds of trees of whatever kind has been recently emphasized because of the virulence of the Chestnut Bark Disease, *Diaporthe*, in the East, and the attacks of the Blister Canker fungus of the apple, *Nummularia discreta*, in Ohio. The meager literature upon the subject of wound coverings for protection against infection by such wound parasites has led to many inquiries. The failure of paints for such coverings and the inaccessibility or high cost of other materials such as preparations of asphaltum, gas tar or grafting wax has led to dangerous inaction on the part of tree owners.

This period of orchard and grove sanitation against wound parasites may be recognized as a fact of today. Plant antisepsis has remained essentially undeveloped, while the benefits from antisepsis in human and animal surgery have been recently made prominent through the tribute paid to the memory of its discoverer, Lord Lister. Plant pathologists are fully conscious of the needs in this line; may we not hope horticulturists will become so? The following suggestions are more or less preliminary to the development of good, impervious dressings for large wounds of trees.

AVAILABLE ANTISEPTIC MATERIALS

Two steps in wound treatment may be found necessary in many cases, although in the average case of pruning to remove a branch with a healthy base only one may be essential. These steps are: (1) Sterilization of the wound surface per se. (2) The application of a dressing to protect from infection through the entrance of spores or bacteria.

(1) The sterilization of the surface of a wound consists in killing any possible spores or bacteria, etc., that may be upon the surface. This may be done by the use of a torch to cauterize the surface, or more easily by the application of an antiseptic or spore destroying substance. Of these germicides we have a large number. Among them we may name corrosive sublimate, gasoline, kerosene, carbolic

acid, petroleum, copper sulfate solution, carbolineum, formaldehyde, etc. The availability of any of these processes will depend especially upon its effect on the living layer of the wounded surface. If the cambium is killed back appreciably it will raise the question of possible injury. Because of such possible injury only corrosive sublimate, copper sulfate and formaldehyde are apparently safe; we know that the petroleum compounds like gasoline, kerosene, etc., penetrate and destroy the living tissues. As to Carbolineum Avenarius, a proprietary substance, some doubt has been expressed. Because of its complete absorption by the wound surface carbolineum offers many advantages. Upon dead surfaces such as those from which decay has been removed, carbolineum is available, as are also carbolic acid and solutions of copper sulfate, corrosive sublimate, etc.

Upon wounds which are made by the removal of a malignant growth such as crown gall, hairy-root or malignant blister cankers, an active antiseptic agent is required, and for such use carbolineum promises to be superior to copper sulfate or corrosive sublimate solutions.

(2) When effective dressings are applied to newly cut surfaces especially if these dressings are of possible antiseptic value, the one operation of applying the dressing may be considered as relatively adequate to the demands.

ESSENTIAL REQUIREMENTS OF A WOUND DRESSING

The essential requirements of a wound dressing appear numerous and more or less antagonistic. For illustration such a dressing should be sufficiently fluid to apply readily under spring pruning conditions. In the second place the dressing should form an impervious, non-cracking layer over the surface, even though it be large, since such a dressing will prevent the later drying out and checking of the wound. These two requirements are essentially antagonistic, since we find there is practically no covering within reasonable range of cost, which will form a good impervious dressing from a single application of the fluid at ordinary temperatures.

This matter of complete covering is of the utmost importance on large cuts. Wound dressings should, by their permanence, render the cut surface impervious to water and exclude air. Whenever the complete continuous covering is not secured by a single application, most likely to be made in the early season, there is serious danger that subsequent checks may occur in the wood and thus the opening be provided for the entrance of disease spores, which in the case of blister canker are actively distributed in the later season. It is this tendency to dry out at once and permit checking that limits the

usefulness of paint dressings, or to a less extent, the use of white lead paste. These preparations may appear to give a good surface when applied, only to dry out and leave conspicuous cracks by mid-summer.

Dressings should furthermore be of reasonable cost, because of the large extent to which they need to be applied. This is a serious objection to grafting-wax, although it has the additional one of separating freely from a large surface when applied there. The same applies to paraffin as a dressing. It is easily abraded and breaks away from the surface upon which it is applied. This really points to the other property more or less assumed, namely, that of the adhesiveness of the dressing to the surface of the wound. An adhesive dressing usually has the additional property of being resistant to abrasion and subsequent separation. Furthermore wound dressings, like antiseptic materials, may not be seriously injurious to the living layer, although a slight killing of a very thin layer is probably not as objectionable as imperfect covering. The resistance of a dressing to the healing growth around the border of a wound may be of importance.

As yet little consideration has been given to rigid materials, except in the case of cement. It would seem from the various characteristics of available materials that we shall be compelled to compromise on the properties of dressings, using always, or practically so, a fluid form in the upper portion of the tree, while for larger wounds near the base, of the type especially found on apple trees, a dressing which requires heating may be most available.

AVAILABLE MATERIALS FOR WOUND DRESSINGS

Possibly by reason of the exacting conditions under which dressings are usually applied upon wounds, the materials commonly used for the purpose are the various protective paints. It is possible further, that the general failure to recognize the ineffectiveness of these coverings has held back progress toward better things. Nothing is more natural, since one uses prepared paint or white lead paint to cover a building, than to apply this covering when one desires to be especially careful to dress a dangerous tree wound. The same applies to preparations of linseed oil and Venetian Red or linseed oil and Chrome Yellow, but for large surfaces these have proved so ineffective as to offer a real menace, in that they lull the user into a false sense of safe protection.

Of the really available materials we have chiefly preparations of asphaltum and the residual tars from the distillation of wood (pitch), and from the manufacture of artificial gas, gas tar. The materials used in Europe under the name of "Bitumen" are essentially forms of liquid asphaltum, usually prepared as a solution of the asphaltum

in the light hydrocarbons similar to gasoline and the various grades of naphtha. The varnishes or proprietary preparations offered for dressing wounds are essentially some such liquid preparation of asphaltum in some form. The fossil "Gilsonite" of California is a hardened form of asphaltum. Most of the special prepared brands of asphaltum are derived from the residuum in the distillation of Western petroleum. These Western petroleums, which are said to contain an asphaltum base, contrast in this regard with the Pennsylvania crude oil, which has a paraffin base. The residuum of the Western oils, according to the stage to which the distillation is carried, will therefore be an asphaltum of a somewhat varying melting point. The distillation of the Pennsylvania oil, on the other hand, gives paraffin, which in its crude state is used as axle grease, etc., and in its rectified forms is prepared for such uses as the manufacture of chewing gum, jar sealing preparations, etc.

For the present we have not mentioned the so-called "coal-tar" preparations derived from preparations of asphaltum by the use of volatile hydrocarbons such as gasoline or naphtha, as solvents.

In addition to being quite fluid the composition of these preparations known as coal-tar paints, leads us to fear that the volatile portion will be absorbed and injury to the cambium result. Some of this fear may prove to be without foundation.

Another advantage of asphaltum and gas tar materials is their low cost as compared with the very high cost of paints containing linseed oil. The low cost of naphtha or gasoline as a solvent is much in its favor, were the preparations without risk.

GAS TAR AND PITCH

By gas tar is meant the residual tar obtained in the distillate from coals used in gas making. This is produced in considerable quantities and there being only a slight demand for the material it is sold at low prices, ranging from 6 to 12 cents per gallon, exclusive of package.

By pitch is meant the pine tar derived from the distillatian of pitch pine.

The gas tar handled in warm weather is quite fluid and very tenacious, with a strong tendency to be completely absorbed by the transverse cut in the wood. Upon this absorption it is not clear that it gives a sufficiently continuous covering over the wound to guard against subsequent openings through its surface. How great the danger may prove from this absorption by the wood we are not yet prepared to state. Experiments are being made to test its relative merits compared with preparations of asphaltum.

FORMS OF SOLID ASPHALTUM

In addition to the more or less impure Trinidad asphaltum, used largely in street paving work, there are available various types of asphaltum, which owing to its semi-fluid character at summer temperature is shipped in sheet iron drums with one end open, or in wooden barrels of the open type. These grades of asphaltum derived as they are, by the distillation of Western petroleum, are essentially pure and differ only in their melting points—this in turn being dependent upon the extent to which the distillation was carried at the refinery. It is now possible to obtain upon the market asphaltum of this type varying in melting point from 200° F. to 285° F., the latter being a form named "Byerlite," for sale by Byerley & Sons, Cleveland, Ohio, at an f. o. b. price of 1½ cent per pound. The asphaltum of lower melting point is offered by The Wells Oil Co., of Columbus, Ohio, at a slightly higher price I believe. All of these grades of asphaltum will require heating in order to apply them.

For the heating special apparatus is desirable, preferably some form of heating pot. We have found a useful one to be a charcoal heating pot prepared with tall bail of sufficient spread to swing freely above a dinner pot or a 10 to 12 quart galvanized bucket. This heater is provided with openings below and vent opening toward the top of the metal cylinder; also legs to keep free from the ground. The fuel used is charcoal. In such a case it is better to melt the vessel of asphaltum upon some hotter fire, and merely to use the heating pot to maintain its temperature in the orchard.

The gasoline torch type of heater may also be used and freely transported in the orchard. It will usually require special modifications in order to enable one to use a sufficiently large vessel for the asphaltum. Special forms may be constructed according to particular needs of the individual by consulting some ingenious metal worker.

The asphaltum is carefully melted until thoroughly liquid and in this condition is applied by means of an old brush, swab or stiff broom on the surface one desires to cover. When freely liquid a thin coating is run over the surface—this may be increased by a second coating after the first one becomes partly cooled. The asphaltum should be run out over the edge of the living tissue. The thickness of the coat to be applied should be determined by the surface, but in general it is desirable to make the coating as thin upon smooth surfaces as will give complete covering. The old stub of a hearth broom has been found convenient for this purpose. New hair brushes are usually destroyed in the highly heated asphaltum. Old stubs of brushes that have been in long use are sometimes capable of service. A swab of cloth applied over a stick of suitable length gives a convenient means of spreading the asphaltum.

ADVANTAGES AND DISADVANTAGES OF SOLID ASPHALTUM

The advantages of the application of solid forms of asphaltum are most appreciated when one has a rough splintered wound or something of the sort to be covered. Here the possibility of filling the cavities with the liquid and making a sloping impervious covering to keep out water is of value. The disadvantages of heating before using are usually very great indeed. Under the ordinary conditions it is not very feasible to build a fire in the orchard, except in moist weather, since there is danger of igniting the mulch or dead grass, and the troubles in maintaining liquid conditions are considerable, since it must be remembered that to apply effectively in a thin coating this asphaltum must be kept hot and very fluid.

Probably the most serious advantage of the solid asphaltum dressing is the tendency to crack off during the winter period. On low cut stumps of catalpa at Mechanicsburg, during the winter of 1911-12, the coverings were all detached, while upon wounds above ground about 15 percent only were impaired in this way. There is danger also where the wound surface is not entirely dry that the presence of moisture will produce bubbles when the asphaltum is applied. This, of coursc, is unsatisfactory and dangerous, especially if these bubbles crack open and expose the surface below. Yet, despite these disadvantages, *for large wounds the melted asphaltum offers a rather higher efficiency than anything else we have tried.*

As brought out by Mr. John Boddy, City Forester of Cleveland, some two years ago, the healing process following such dressings ranks very high as compared with other dressings applied as liquids at ordinary temperatures, and the percentage of complete protective covering appears to be much higher with melted asphaltum than we have yet been able to obtain with other preparations, unless these dressings are renewed by a second or third coat.

LIQUID FORMS OF ASPHALTUM*

The difficulty with liquid forms of asphaltum is largely due to the character of the solvent substances. I mentioned that gasoline, or as a group, the petroleum naphthas are capable of dissolving asphaltum and making a fairly thick substance known as coal tar paint, which is used for roofing paint, covering iron fences and other metal work. Liquid asphaltum wound dressings must be dissolved in such a way as to avoid injury to the living layer of the host exposed by the wound. I have mentioned that these liquid forms of asphaltum called "Bitumen" may possibly be used safely if admixed

*These are based upon the work of Mr. Boddy, and upon experiments conducted with Varnolene and other oils in the laboratory of the Station.

with some vegetable oils or with a mixture of vegetable oils like a mixture of linseed oil and nut oil, or linseed oil and peanut oil or linseed oil and corn oil. It is in some such way as this, namely, by taking the liquid asphaltum prepared by use of naphtha and adding a mixture of vegetable oils thereto, and possibly with the addition of some soluble gum, that commercial tree dressings are prepared.

Mr. John Boddy, City Forester of Cleveland, Ohio, last winter took up the matter of a solvent preparation for asphaltum with representatives of The Standard Oil Company. As a consequence we have now offered upon the market available for purchase, a compound oil containing more or less naphtha, sold under the trade name of "Varnolene." This has a flash point of 102 to 103° F., and if used in the proportion of 2½ parts of oil by weight to one part of solid asphaltum by weight, makes a preparation that can be used in winter, while used at the rate of 1¾ to 2 parts of Varnolene to one part by weight of asphaltum, it gives a preparation of suitable consistency for warmer weather. For the present we are disposed to look upon these liquid preparations of asphaltum of known composition with more favor than the commercial preparations, presumptively using forms of gasoline as solvents.

MAKING LIQUID FORMS OF ASPHALTUM

To make for immediate use any liquid form of asphaltum, it is necessary to have the solvent oil on hands together with a supply of asphaltum. The Varnolene of 102 to 103° flash point, stated above, can be bought for 15 cents per gallon, f. o. b. point of shipment at Cleveland or Columbus. Linseed oil at this time costs about $1.00 per gallon. Peanut oil and corn oil I believe sell at slightly higher prices than linseed oil, so that except for the matter of available supply to use, the cost of materials is much greater to use vegetable oils than the proprietary Varnolene.

To make liquid asphaltum, use say 10 pounds of solid Byerlite asphaltum to 20 pounds of Varnolene. Melt the asphaltum in a vessel of several gallons capacity, say a good sized kettle. When thoroughly melted *withdraw the fire*, then add the Varnolene and stir thoroughly until of uniform character. If desired the vessel can be again heated and uniformity better assured. This gives suitable consistency for warm weather, and is in proportion of one part asphaltum to two parts Varnolene by weight. In the winter time a preparation of one part asphaltum to 2½ parts Varnolene by weight may be desired.

WARNING—*When the Varnolene is added to the hot asphaltum an inflamable gas is liberated which ignites after the manner of gasoline vapor.*

This formula is for asphaltum having a melting point of 285° F. With asphaltum with a melting point of 200° F. the proportion of Varnolene will be reduced.

LINSEED OIL FLUID ASPHALTUM

To make a fluid asphaltum from linseed oil use one part of asphaltum by weight to 1¾ to 2 parts of linseed oil by weight. Heat the asphaltum until thoroughly liquid then add the linseed oil as per directions given above. The danger from the formation of inflammable gases is much less with the linseed oil than with the Varnolene, but can not be entirely overlooked.

These forms of liquid asphaltum may be prepared and packed in suitable cans for use at any time required. They should really be put up in tin cans and soldered, since exposure to the air will make a slight difference in the consistency.

PROPRIETARY WOUND DRESSINGS

A proprietary wound dressing known as Hoyt's Tree Varnish is on sale in the trade. This can be obtained in two consistencies. The thicker one is much to be preferred in warm weather, as it produces a much better covering. The manufacturer's agent for this material recommends the use of a dressing of carbolineum previous to the application of the tree varnish. However, as stated above, in the case of ordinary fresh wounds this is not always thought to be safe. In any case, unless the consistency is greater than has usually been found, two or three coats of the tree varnish will be required to make a complete covering over the surface of the wound when large.

CONCLUSION

The preliminary outlines in this Circular have been prepared to assist in the development of cheap and effective wound dressings for trees of all kinds. Reports of tests by foresters and orchardists are earnestly solicited. All are urged to face the problems offered by our present day conditions and to join with others in working out successful wound coverings.

Correspondence upon the subject is solicited.